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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/518,182	ROUTLEY ET AL.	
	Examiner	Art Unit	
	Jason M. Mandeville	2609	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 June 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-31* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-31* is/are rejected.

7)☒ Claim(s) *1* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *20 June 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *16 December 2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. **Claim 1** is objected to because of the following informalities: the word "electroluminscent" is misspelled and should be replaced with "electroluminescent". Appropriate correction is required.

Claim Rejections - 35 USC § 101

2. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Claim 16 is rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. Claim 16 attempts to claim rights to a carrier carrying the processor control code of claim 1. The specification relates that the carrier "may comprise any conventional data carrier or storage medium such as a hard or floppy disk, ROM, or CD-ROM or an optical or electrical signal carrier" (see Page 17). The "optical or electrical signal carrier" is intangible and therefore does not constitute a process, machine, manufacture, or composition of matter.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. **Claims 1-7, 10, 14-16, 28, and 30** are rejected under 35 U.S.C. 103(a) as being unpatentable over Kimura et al. (hereinafter "Kimura"; US 6,518,962) in view of Shen et al. (hereinafter "Shen"; US 6,414,661).

3. As pertaining to **claim 1**, Kimura discloses a display driver (see Fig. 3, Fig. 5, and Fig. 6; *it should be noted that Fig. 3 depicts a configuration of a display driver for the driving of the common electrode, Fig. 5 depicts a configuration for the driving of the opposing electrode, and Fig. 6 depicts a configuration for the driving of the signal line; Kimura discloses an electroluminescent display that can be driven in a manner consistent with any of the above mentioned figures (see Col. 23, Ln. 18-46) such that any of the voltage sources or power supplies can be controlled in a similar manner; while the descriptions provided in this office action relate specifically to Fig. 6 the referenced descriptions are equivalent for the other embodiments of the invention shown in Fig. 3 and Fig. 5*) for an electroluminescent display (see Fig. 1), the display comprising a plurality of electroluminescent display elements (10; Col. 20, Ln. 9-25);

display elements are herein equivalently referred to as "pixels" containing organic electroluminescent devices) each associated with a display element driver circuit (13, 22c, 21a, 23, 16; in Fig. 5, the combined circuit elements of the signal line driving circuit (12), the voltage control circuit (22c), the current comparison circuit (21a), the voltage controller (23), and the current measuring equipment (16) comprise the display element driver circuit), each said display element driver circuit (13, 22c, 21a, 23, 16) including a drive transistor (223) having a control connection (132) for driving the associated display element (10) in accordance with a voltage (voltage output of 12) on the control connection (132), (Col. 20, Ln. 9-62; Col. 21, Ln. 29-52) the display driver comprising:

at least one display element brightness controller (23, 22c, 21a, 16; the combination of the voltage controller (23), the voltage control circuit (22c), the current comparison circuit (21a) and the current measuring equipment (16) inherently comprise a brightness controller) to provide an output (output of 22c) to drive a said control connection (132) to control the electroluminescent output (electroluminescent output of 224) from a said display element (10; Col. 20; Ln. 41-62; the electroluminescent output from a display element (10) is inherently a function of the current that flows through the electroluminescent device (224) contained in the display element (10) and the voltage applied to the drive transistors (223); the current and voltage of each display element (10) is controlled by the combined brightness controller circuit formed by (23, 22c, 21a, and 16)); and

a power controller (23) for controlling an adjustable power supply (output of 12 in Fig. 6 or 14 in Fig. 5 or 13 in Fig. 3) for providing an adjustable voltage (voltage on 132

or voltage on the opposing electrode or voltage on 133) to said electroluminescent display (15) to power said drive transistors (223) for driving said display elements (10), said power controller (23) being configured to provide a control signal (output of 23) to adjust said power supply voltage (output of 12 or 13 or 14) in response to a sensed voltage (Col. 22, Ln. 10-51).

Kimura teaches a current sensor (16) to sense the driving current (ID) through the control connection drive transistor (223). The sensed current corresponds to the control (gate) voltage of drive transistor (223; see Col. 20, Ln. 41-62). However, Kimura does not explicitly disclose a voltage sensor to sense the voltage on a said control connection.

Shen discloses a method and associated system that compensates for long-term variations in the light-emitting efficiency of organic light emitting diodes in an electroluminescent display device (see Fig. 3 and Abstract). In order to produce a constant driver current through an electroluminescent element, Shen utilizes a voltage adjustment that is generated through the use of a correction current applied to a current-to-voltage converter (43; see Abstract and Col. 7, Ln. 1-15). It would have been obvious to one of ordinary skill in the art at the time when the invention was made to combine the teachings of Kimura with the teachings of Shen in order to convert the current measurement of Kimura into the voltage measurement of Shen to effectively produce a voltage sensor (16) to sense the voltage on the control connection (132 or gate line of 223; also see Col. 21; Ln. 57-67; Col. 22, Ln. 1-66).

4. As pertaining to **claim 2**, Kimura discloses that the display drive transistors of claim 1 are thin film transistors (TFTs), which are a form of field effect transistors (Col. 1, Ln, 25-27). In addition, Kimura teaches that the drive transistors can comprise field effect transistors (FETs) (Col. 21, Ln. 5-10) wherein said control connection comprises a gate connection (Col. 1, Ln. 45-58; Col. 20, Ln. 41-62; see Fig. 6; Col. 23, Ln. 39-46 in which the gate connection is specifically controlled in the manner described herein).

5. As pertaining to **claim 3**, Kimura teaches that the display of claim 1 comprises an active matrix display (100) with a plurality of control lines (132) for driving said control connections (control lines (132) and gate connection of (223) directly, see Fig. 6), and wherein said brightness controller (23, 22c, 21a, 16) is configured to drive said control lines (132; Col. 20, Ln. 9-62).

6. As pertaining to **claim 4**, Kimura teaches that the voltage sensor (16) of claim 3 is configured to sense the voltage on a control connection (132) by sensing the voltage on a said control line (Col. 20, Ln. 41-62; Col. 21; Ln. 57-67; Col. 22, Ln. 1-51).

7. As pertaining to **claim 5**, Kimura discloses a display driver of claim 1 (see Fig. 1 and Fig. 6) wherein said brightness controller (23, 22c, 21a, 16) comprises a substantially constant current generator (21a, 22c, 23, ID, and Iref input to 21a; Col. 3, Ln. 14-33; Col. 21, Ln. 57-67; Col. 22, Ln. 1-39; the components 21a, 22c, 23, ID, and

Iref form a constant current generator; Iref is a predetermined reference current for driving the electroluminescent device (224); the function of 21a, 22c, and 23 is to maintain the current through the device (224) such that the current is substantially constant).

8. As pertaining to **claim 6**, Kimura teaches that the voltage on the control connection (output voltage of 22c) of claim 5 is substantially determined by a current level (the current level Iref) of the substantially constant current generator (21a, 22c, 23, ID, Iref; see Fig. 4; Col. 21, Ln. 57-67; Col. 22, Ln. 1-51).

9. As pertaining to **claim 7**, Kimura also teaches that the display element driver circuit (13, 22c, 21a, 23, 16) of claim 6 includes a photodiode (see Fig. 9, Fig. 15, Fig. 19 in which the current measuring equipment (16) of Fig. 6 has been replaced with a quantity-of-emitted-light measuring equipment (18) of Fig. 9; thus, the display element driver circuit now includes (13, 22c, 21a, 23, and 18; in Fig. 19, an example of a quantity-of-emitted-light measuring device is provided as a PIN diode; the PIN diode is inherently the equivalent of the photodiode); and wherein a photocurrent through said photodiode (110 in Fig. 19) is determined by said current level to determine the brightness of said display element (see Col. 36, Ln. 33-67, Col. 37, Ln. 1-8, Col. 22, Ln. 10-51; the quantity-of-light-measuring device (see Fig. 19 and Fig. 9) or photodiode is provided, along with the current measuring circuit (16") to measure the current for each pixel (10) that flows through the electroluminescent element (224); by using this method

to capture a quantity-of-light measurement and an associated current level, the current measuring equipment (16) of Fig. 6 is represented equivalently by the associated quantity-of-light measuring equipment (18) of Fig. 9 and the current measuring circuit (16") of Fig. 19).

10. As pertaining to **claim 10**, Kimura discloses that the sensed voltage (16; see Fig. 6) of claim 8 comprises a voltage on a control connection (132) of a display element (223, 224) having a maximum brightness relative to others of the display elements (Col. 22, Ln. 10-67, Col. 23, Ln. 1-11; each display element (224) inherently has a maximum brightness relative to the other display elements as determined by the current Iref, the data signal for each pixel, and the relative age and deterioration over time; also, see Fig. 6 and Fig. 7, as well as Col. 23, Ln. 39-67 and Col. 24, Ln. 1-22).

11. As pertaining to **claim 14**, Kimura discloses a display driver of claim 1 (see Fig. 1 and Fig. 6) comprising the adjustable power supply (the adjustable power supply is inherent in 22c and 23; Col. 22, Ln. 10-51).

12. As pertaining to **claim 28**, Kimura teaches the display driver of claim 1, wherein the electroluminescent display comprises an organic light emitting diode display (see Fig. 1; Col. 21, Ln. 5-10).

13. As pertaining to **claim 15,** Kimura discloses (see Fig. 19 and Fig. 6) a power controller (110, 204, 16", 205, 207, 209, and 12; the PIN or photodiode (110), light-detecting driving circuit (204), current measuring circuit (16"), common line power source (205), frame memory (207), deterioration correction circuit (209), and signal line driving circuit (12) comprise the power controller) for a display driver for an electroluminescent display (115), the display comprising a plurality of electroluminescent display elements (224) each associated with a display element driver circuit (11, 12, 205), each said display element driver circuit including a drive transistor (223) having a control connection (132) for driving the associated display element (224) in accordance with a voltage on the control connection (132), the power controller (110, 204,16", 205, 207,209, and 12) comprising (see Col. 36, Ln. 33-67; Col. 37, Ln. 1-8; Col. 37, Ln. 37-67; Col. 38, Ln. 1-40):

a memory (207) storing processor control code (output of 16"; the control code stored by the frame memory (207) is the current IDmn);

a processor (209) coupled to the memory (207) for executing said processor control code (output of 16");

a control signal output (output of 209) for controlling an adjustable power supply (12) for providing an adjustable voltage (132) to said electroluminescent display (115) to power said drive transistors (223) for driving said display elements (224; see Fig. 21a and Fig. 21b; the control signal output controls the power supply (12) based on the output of the frame memory (207));

said processor control code (output of 16") comprising instructions for controlling the processor (209) to read said sensed voltage input (output of 207) and to output a control signal (output of 209) to adjust said power supply (12) in response to said sensed voltage. (The frame memory (207) stores a quantity of measured current (IDmn) representative of the current through the electroluminescent device (224); the measured current is inherently a measure of sensed voltage on the control connection (see Col. 20, Ln. 41-62); further, the quantity of measured current, or voltage, is inherently a control code for the processor (209) which comprises instructions for controlling the processor (209); the measured current (voltage) is supplied to the processor (209) as instructions to adjust the power supply (12) based on a certain "signal conversion curve" corresponding to the sensed current or voltage).

Kimura teaches a current sensor (16) to sense the driving current (ID) through the control connection drive transistor (223). The sensed current corresponds to the control (gate) voltage of drive transistor (223; see Col. 20, Ln. 41-62). However, Kimura does not explicitly disclose a voltage sensor to sense the voltage on a said control connection.

Shen discloses a method and associated system that compensates for long-term variations in the light-emitting efficiency of organic light emitting diodes in an electroluminescent display device (see Fig. 3 and Abstract). In order to produce a constant driver current through an electroluminescent element, Shen utilizes a voltage adjustment that is generated through the use of a correction current applied to a

current-to-voltage converter (43; see Abstract and Col. 7, Ln. 1-15). It would have been obvious to one of ordinary skill in the art at the time when the invention was made to combine the teachings of Kimura with the teachings of Shen in order to convert the current measurement of Kimura into the voltage measurement of Shen to effectively produce a voltage sensor (see (16") in Kimura Fig. 19) to sense the voltage on the control connection (132 or gate line of 223; also see Col. 21; Ln. 57-67; Col. 22, Ln. 1-66).

14. As pertaining to **claim 16**, Kimura teaches that the control code of claim 15 is carried from the frame memory (207) to the processor (209; see Fig. 19) by means of a wire.

15. As pertaining to **claim 30**, Kimura teaches the power controller of claim 15, wherein the electroluminescent display comprises an organic light emitting diode display (see Fig. 1; Col. 21, Ln. 5-10).

16. **Claims 8-9, 11-13, 17-27, 29, and 31** are rejected under 35 U.S.C. 103(a) as being unpatentable over Kimura in view of Shen and further in view of Young et al. (hereinafter "Young"; US 6,738,031).

17. As pertaining to **Claim 8,** Kimura teaches the display driver of claim 5 (see Fig. 6 and Fig. 4). Kimura also discloses a number of driver configurations (see Fig. 3, Fig. 5, and Fig. 6) in which the power controller (23) is configured to control the power supply voltage (output of 22a,b,or c) when a sensed voltage on a control connection needs to be increased or reduced to produce the current Iref through the electroluminescent device (224). However, Kimura does not explicitly state that the power controller (23) is configured to reduce the power supply voltage (output of 22a) when a sensed voltage on a control connection is less than a threshold voltage.

Young discloses an active matrix electroluminescent display device (see Fig. 1 and Fig. 2) with light sensing elements (40) in which a photosensitive device, or photodiode, is utilized in order to maintain a constant current through an electroluminescent display device (Col. 1, Ln. 30-67). Young states that in order to maintain a constant current through an electroluminescent element (20), it is possible to sense the voltage or current through the element (20) using the photosensitive device (40; see Col. 4, Ln. 63-67 through Col. 5, Ln. 1-51 and Col. 6, Ln. 31-67 through Col. 7, Ln. 1). Young teaches that the TFT (22) is the driving device for the electroluminescent element (20). Further, Young teaches that during operation of the driving device (22) and obviously during non-operation, "slight variations of the drain voltage do not affect the current flowing through the display element (20)." So, "the voltage on the voltage supply line (30) is therefore not critical to the correct operation of the pixels." Therefore, it would have been obvious to one of ordinary skill in the art at the time when the invention was made that for any arbitrary threshold value for a sensed voltage on a

control connection (24), the voltage on the voltage supply line (30) can be reduced without affecting the operation of the pixels. Further, it would have been obvious to one of ordinary skill in the art at the time when the invention was made to combine the teachings of Kimura with the teachings of Young in order to produce a constant current through the electroluminescent device by utilizing the power controller to reduce the power supply voltage (see Fig. 5, Col. 23, Ln. 29-38 in Kimura) when a sensed voltage on the control connection is less than a threshold voltage.

18. As further pertaining to **Claim 9**, Kimura teaches the display driver of claim 8 (see Fig. 6 and Fig. 4). However, Kimura does not explicitly state that the threshold voltage is substantially equal to a maximum available output voltage for outputting from said brightness controller to said display.

Again, Young discloses an active matrix electroluminescent display device (see Fig. 1 and Fig. 2) with light sensing elements (40) in which a photosensitive device, or photodiode, is utilized in order to maintain a constant current through an electroluminescent display device (Col. 1, Ln. 30-67). Young states that in order to maintain a constant current through an electroluminescent element (20), it is possible to sense the voltage or current through the element (20) using the photosensitive device (40; see Col. 4, Ln. 63-67 through Col. 5, Ln. 1-51 and Col. 6, Ln. 31-67 through Col. 7, Ln. 1). Young teaches that during operation of the driving device (22) and obviously during non-operation, "slight variations of the drain voltage do not affect the current flowing through the display element (20)." So, "the voltage on the voltage supply line

(30) is therefore not critical to the correct operation of the pixels." Therefore, it would have been obvious to one of ordinary skill in the art at the time when the invention was made that any arbitrary threshold value for a sensed voltage on a control connection (24) can be made, including the maximum available voltage for outputting from the brightness controller to the display, and the voltage on the voltage supply line (30) can be reduced without affecting the operation of the pixels. Further, it would have been obvious to one of ordinary skill in the art at the time when the invention was made to combine the teachings of Kimura with the teachings of Young in order to produce a constant current through the electroluminescent device by utilizing a threshold value substantially equal to a maximum available voltage for outputting from the brightness controller to the display.

19. As pertaining to **Claim 11**, Kimura discloses a display driver of claim 1 wherein the power controller (23) is configured to increase or reduce the power supply voltage (output of 22a,b, or c; see Fig. 3, Fig. 5, and Fig. 6; Col. 23, Ln. 18-46 and Col. 21, Ln. 29-67 through Col. 22, Ln. 1-62) in order to produce the current Iref through the electroluminescent device (224). However, Kimura does not explicitly teach that the power supply voltage will be reduced to substantially no more than required by a brightest illuminated display element.

Again, Young teaches that during operation of the driving device (22) and obviously during non-operation, "slight variations of the drain voltage do not affect the current flowing through the display element (20)." So, "the voltage on the voltage

supply line (30) is therefore not critical to the correct operation of the pixels." Therefore, it would have been obvious to one of ordinary skill in the art at the time when the invention was made that the voltage on the voltage supply line (30) can be reduced without affecting the operation of the pixels. Also, it would have been obvious to one of ordinary skill in the art that the display driver of Young is configured to reduce the power supply voltage to substantially no more than required by a brightest illuminated display element, because in order to display the brightest illuminated display element, the power supply voltage cannot be reduced beyond that required by the brightest illuminated display element. Further, it would have been obvious to one of ordinary skill in the art at the time when the invention was made to combine the teachings of Kimura with the teachings of Young in order to produce a constant current through the electroluminescent device in which the power controller is configured to reduce the power supply voltage to substantially no more than required by a brightest illuminated display element.

20. As pertaining to **Claim 12**, Kimura discloses a display driver wherein a said display element driver circuit includes a photodiode to both increase and reduce the control connection voltage in accordance with the brightness of the associated display element (see Fig. 9, Fig. 15, and Fig. 19; see Col. 36, Ln. 33-67, Col. 37, Ln. 1-8, Col. 22, Ln. 10-51). However, Kimura does not explicitly state that the power controller is configured to reduce said power supply voltage when the control connection voltage of

the brightest illuminated display element has reduced to less than a first threshold value after a predetermined interval.

Again, Young teaches that during operation of the driving device (22) and obviously during non-operation, "slight variations of the drain voltage do not affect the current flowing through the display element (20)." So, "the voltage on the voltage supply line (30) is therefore not critical to the correct operation of the pixels." Further, Young states that (see Col. 6, Ln. 56-67 through Col. 7, Ln. 1) as the current flowing through the display element (20) gradually decreases, the driving device (22) will eventually reach its threshold voltage and turn off. It would have been obvious to one of ordinary skill in the art at the time when the invention was made that once the control connection of the brightest illuminated display element has reduced to less than this first threshold value after a predetermined interval, the voltage on the voltage supply line (30) can be reduced without affecting the operation of the pixels since the driving transistors (22) will effectively be off. Further, it would have been obvious to one of ordinary skill in the art at the time when the invention was made to combine the teachings of Kimura with the teachings of Young in order to produce a constant current through the electroluminescent device in which the power controller is configured to reduce the power supply voltage when the control connection voltage of the brightest illuminated display element has reduced to less than a first threshold value after a predetermined interval.

21. As pertaining to **Claim 13**, Kimura discloses a display driver wherein a said display element driver circuit includes a photodiode to both increase and reduce the control connection voltage in accordance with the brightness of the associated display element (see Fig. 9, Fig. 15, and Fig. 19; see Col. 36, Ln. 33-67, Col. 37, Ln. 1-8, Col. 22, Ln. 10-51). However, Kimura does not explicitly state that the power controller is configured to increase the power supply voltage when the control connection voltage of the brightest illuminated display element has not reduced to less than a second threshold value after a predetermined interval.

Again, Young teaches that during operation of the driving device (22) and obviously during non-operation, "slight variations of the drain voltage do not affect the current flowing through the display element (20)." So, "the voltage on the voltage supply line (30) is therefore not critical to the correct operation of the pixels." Further, Young states that (see Col. 6, Ln. 56-67 through Col. 7, Ln. 1) as the current flowing through the display element (20) gradually decreases, the driving device (22) will eventually reach its threshold voltage and turn off. It would have been obvious to one of ordinary skill in the art at the time when the invention was made that increasing or decreasing the supply voltage when the brightest illuminated display element has not reduced to less than a second threshold value after a predetermined interval, the voltage on the voltage supply line (30) can be reduced without affecting the operation of the pixels. Further, it would have been obvious to one of ordinary skill in the art at the time when the invention was made to combine the teachings of Kimura with the teachings of Young in order to produce a constant current through the

electroluminescent device in which the power controller is configured to increase the power supply voltage when the control connection voltage of the brightest illuminated display element has not reduced to less than a second threshold value after a predetermined interval.

22. As pertaining to **Claim 17**, Kimura discloses a method of operating an active matrix electroluminescent display (see Fig. 1 and Fig. 6), the display comprising a plurality of pixels (10, Col. 20, Ln. 9-25) each with an associated pixel driver (13, 22c, 21a, 23, 16; also, see Fig. 3, Fig. 5, and Fig. 6; *again, it should be noted that Fig. 3, Fig. 5, and Fig. 6 represent alternative driving means disclosed by Kimura (see Col. 23, Ln. 18-46); the descriptions provided in this office action relate specifically Fig. 6), but these descriptions are equivalent for the other embodiments of the invention shown in Fig. 3 and Fig. 5*), the display having a power supply (22a,b, or c) and plurality of control lines (132) for setting the brightness (referred to herein as luminance) of each pixel (10), the method comprising:

setting the brightness pixels of the display using said control lines (the brightness of pixels in the display is set by the previously described brightness controller (23, 22c, 21a, and 16) which controls the electroluminescent output of (224); Col. 20; Ln. 41-62; the current and voltage of each display element (10) is controlled by the combined brightness controller circuit formed by (23, 22c, 21a, and 16));

monitoring control lines of the display (the control lines are monitored by the current sensor or, equivalently, voltage sensor (16) which senses the current or voltage on the control line (132); Col. 21; Ln. 57-67; Col. 22, Ln. 1-51).

Kimura teaches that the power supply is responsive to the monitoring (the previously described power controller (23) is used for controlling an adjustable power supply (inherent in 22a,b, or c) for providing an adjustable voltage (voltage on 132) to the electroluminescent display (15) to power said drive transistors (223); in reference to Fig. 4 and Col. 22, Ln. 10-51; the power controller (23) is intended to control the supply voltage such that the current Iref is produced through the electroluminescent device (224); the voltage adjustment inherently includes both increasing and reducing the voltage on the control connection (132) in order to produce the reference current Iref through the electroluminescent device (224); further, see Fig. 5 and Fig. 6 and Col. 23, Ln. 18-46). However, Kimura does not explicitly state the reducing of the power supply responsive to the monitoring.

Young teaches that during operation of the driving device (22) and obviously during non-operation, "slight variations of the drain voltage do not affect the current flowing through the display element (20)." So, "the voltage on the voltage supply line (30) is therefore not critical to the correct operation of the pixels." Further, it is a goal of Kimura (see Col. 1, Ln. 59-64) to provide "low power consumption." Therefore, it would have been obvious to one of ordinary skill in the art at the time when the invention was made to combine the teachings of Kimura with the teachings of Young since increasing

or reducing the power supply voltage is not critical to the correct operation of the pixels and decreasing the power supply supports low power consumption.

23. As pertaining to **claim 18**, Kimura teaches the method that the pixel driver (13) associated with each display pixel includes a drive transistor (224) to drive an electroluminescent display element (10), and wherein said monitoring comprises monitoring a control voltage (voltage at gate of 223) of said drive transistor (223) by monitoring said control lines (132; the voltage control circuit (16) senses the current or, equivalently, voltage on the control connection (132); Col. 21; Ln. 57-67; Col. 22, Ln. 1-51).

24. As pertaining to **claim 19**, Kimura discloses that the drive transistors are thin film transistors (TFTs), which are a form of field effect transistors (FETs). In addition, Kimura teaches that the drive transistors can comprise FETs in (Col. 21, Ln. 5-10) and that the control voltage can comprise a gate voltage of the FET transistor (Col. 1, Ln. 45-58; Col. 20, Ln. 41-62; also, see Fig. 6; Col. 23, Ln. 39-46).

25. As pertaining to **Claim 20**, Kimura teaches the method of claim 17 in which the maximum pixel brightness is inherently determined by the signal data and the reference current Iref (the maximum pixel brightness is inherently determined by the signal data, the current Iref, and the relative age and deterioration over time of the pixel; Col. 22, Ln. 10-67, Col. 23, Ln. 1-11; each display element (224) inherently has a maximum

brightness relative to the other display elements; see Fig. 6 and Fig. 7, as well as Col. 23, Ln. 39-67 and Col. 24, Ln. 1-22; the power supply voltage (Fig. 5 and Fig. 6) will be increased or reduced in order to produce the current Iref through the electroluminescent element (224); because the power supply voltage will be made to produce Iref, it will inherently be increased or reduced to substantially no more than required by the maximum pixel brightness). However, Kimura does not explicitly state that the reducing comprises reducing the power supply to substantially no more than required by said maximum pixel brightness.

Young teaches that during operation of the driving device (22) and obviously during non-operation, "slight variations of the drain voltage do not affect the current flowing through the display element (20)." So, "the voltage on the voltage supply line (30) is therefore not critical to the correct operation of the pixels." Again, it is a goal of Kimura (see Col. 1, Ln. 59-64) to provide "low power consumption." Therefore, it would have been obvious to one of ordinary skill in the art at the time when the invention was made to combine the teachings of Kimura with the teachings of Young since increasing or reducing the power supply voltage is not critical to the correct operation of the pixels and decreasing the power supply supports low power consumption. Also, it would have been obvious to one of ordinary skill in the art that the display driver of Young is configured to reduce the power supply voltage to substantially no more than required by a brightest illuminated display element, because in order to display the brightest illuminated display element the power supply voltage cannot be reduced beyond that required by the brightest illuminated display element.

26. As pertaining to **Claim 21**, Kimura teaches the method of claim 17 (see Fig. 4, Col. 22, Ln. 10-51; the voltage adjustment inherently includes increasing or decreasing the power supply voltage in order to produce Iref across the electroluminescent device (see Fig. 5, Fig. 6, Col. 23, Ln. 18-46); the maximum available voltage is inherently determined by the voltage necessary to produce Iref across the electroluminescent device or by the maximum voltage of the power supply; the increase or reduction in power supply voltage also, see Fig. 6 and Fig. 7, Col. 23, Ln. 39-67 and Col. 23, Ln. 1-22). However, Kimura does not explicitly state that the reducing comprises reducing the power supply until the control voltage reaches a maximum available control voltage.

Again, Young teaches that during operation of the driving device (22) and obviously during non-operation, "slight variations of the drain voltage do not affect the current flowing through the display element (20)." So, "the voltage on the voltage supply line (30) is therefore not critical to the correct operation of the pixels." Again, it is a goal of Kimura (see Col. 1, Ln. 59-64) to provide "low power consumption." Therefore, it would have been obvious to one of ordinary skill in the art at the time when the invention was made to combine the teachings of Kimura with the teachings of Young since increasing or reducing the power supply voltage is not critical to the correct operation of the pixels and decreasing the power supply supports low power consumption. Further, it would have been obvious to one of ordinary skill in the art that in order to maintain the current through the electroluminescent element, the transistor (22) must remain in an on state. Therefore, the control voltage must be made to drive

the transistor (22) to its on state. For this reason, it would have been obvious to one of ordinary skill in the art at the time the invention was made that in combining the teachings of Kimura and Young to reduce the power supply voltage, the power supply voltage cannot be reduced beyond that which would cause transistor (22) to turn off, or equivalently, which would require the control voltage to reach beyond its maximum available control voltage.

27. As pertaining to **claim 22**, Kimura discloses that setting the brightness of a pixel (10) comprises setting a current on a said control line (see Fig. 1 and Fig. 6 where a brightness controller (23, 22c, 21a, 16) produces a constant current using (21a, 22c, 23, ID, and Iref input to 21a; Col. 3, Ln. 14-33; Col. 21, Ln. 57-67; Col. 22, Ln. 1-39; here, Iref is a predetermined reference current for driving the electroluminescent device (224); the function of 21a, 22a, and 23 is to maintain the current through the device (224) such that the current is substantially constant at Iref).

28. Further, as pertaining to **claim 23,** Kimura discloses that the pixel driver includes a photodiode (see Fig. 9, Fig. 15, Fig. 19 in which the current measuring equipment (16) of Fig. 6 has been replaced with a quantity-of-emitted-light measuring equipment (18) of Fig. 9; thus, the display element driver circuit now includes (13, 22a, 21a, 23, and 18; in Fig. 19, an example of a quantity-of-emitted-light measuring device is provided as a PIN diode; the PIN diode is inherently the equivalent of the photodiode) and the current comprises a current through the photodiode (see Col. 36, Ln. 33-67, Col. 37, Ln. 1-8,

Col. 22, Ln. 10-51; the quantity-of-light-measuring device (see Fig. 19 and Fig. 9) or photodiode is provided, along with the current measuring circuit (16") to measure the current for each pixel (10) that flows through the photodiode; by using this method to capture a quantity-of-light measurement and an associated current level, the current measuring equipment (16) of Fig. 6 is represented equivalently by the associated quantity-of-light measuring equipment (18) of Fig. 9 and the current measuring circuit (16") of Fig. 19).

29. As pertaining to **Claim 24,** Kimura discloses a method wherein setting the brightness of a pixel of the display comprises setting a pixel brightness voltage on a control line wherein the pixel driver includes a photodiode. However, Kimura does not explicitly state that the pixel driver includes a photodiode configured to cause the pixel brightness voltage to decay over time according to the brightness of an associated pixel and wherein the control voltage comprises the decayed pixel brightness voltage.

Young teaches (see Fig. 2, Fig. 6) a pixel driver includes a photodiode (40) configured to cause a pixel brightness voltage to decay over time according to the brightness of an associated pixel and wherein the control voltage comprises the decayed pixel brightness voltage (Col. 6, Ln. 31-66). It would have been obvious to one of ordinary skill in the art at the time when the invention was made to combine the teaching of Kimura with the teachings of Young in order to produce a constant current through the electroluminescent device in which the photodiode is configured to cause the pixel brightness voltage to decay over time according to the brightness of an

associated pixel and wherein the control voltage comprises the decayed pixel brightness voltage.

30. As pertaining to **Claim 25**, Kimura discloses that increasing or reducing the power supply is responsive to monitoring. However, Kimura does not explicitly teach that reducing the power supply is responsive to monitoring establishing that the decayed pixel brightness voltage of a pixel has decayed to less than a first threshold voltage.

Again, Young teaches (see Fig. 2, Fig. 6) a pixel driver includes a photodiode (40) configured to cause a pixel brightness voltage to decay over time according to the brightness of an associated pixel and wherein the control voltage comprises the decayed pixel brightness voltage (Col. 6, Ln. 31-66. Young also teaches that during operation of the driving device (22) and obviously during non-operation, "slight variations of the drain voltage do not affect the current flowing through the display element (20)." So, "the voltage on the voltage supply line (30) is therefore not critical to the correct operation of the pixels." Further, Young states that (see Col. 6, Ln. 56-67 through Col. 7, Ln. 1) as the current flowing through the display element (20) gradually decreases, the driving device (22) will eventually reach its threshold voltage and turn off. It would have been obvious to one of ordinary skill in the art at the time when the invention was made that once the control connection of the brightest illuminated display element has reduced to less than this first threshold value after a predetermined interval, the voltage on the voltage supply line (30) can be reduced without affecting the

operation of the pixels since the driving transistors (22) will effectively be off. Further, it would have been obvious to one of ordinary skill in the art at the time when the invention was made to combine the teachings of Kimura with the teachings of Young in order to produce a constant current through the electroluminescent device with low power consumption in which reducing the power supply is responsive to monitoring establishing that the decayed pixel brightness voltage of a pixel has decayed to less than a first threshold voltage.

31. As pertaining to **Claim 26**, Kimura discloses a method comprising increasing the power supply responsive to monitoring. However, Kimura does not explicitly teach that reducing the power supply is responsive to monitoring establishing that the decayed pixel brightness voltage of a pixel has not decayed to less than a second threshold voltage.

Again, Young teaches that during operation of the driving device (22) and obviously during non-operation, "slight variations of the drain voltage do not affect the current flowing through the display element (20)." So, "the voltage on the voltage supply line (30) is therefore not critical to the correct operation of the pixels." Further, Young states that (see Col. 6, Ln. 56-67 through Col. 7, Ln. 1) as the current flowing through the display element (20) gradually decreases, the driving device (22) will eventually reach its threshold voltage and turn off. It would have been obvious to one of ordinary skill in the art at the time when the invention was made that increasing or decreasing the supply voltage when the brightest illuminated display element has not

reduced to less than a second threshold value after a predetermined interval, the voltage on the voltage supply line (30) can be reduced without affecting the operation of the pixels. Further, it would have been obvious to one of ordinary skill in the art at the time when the invention was made to combine the teachings of Kimura with the teachings of Young in order to produce a constant current through the electroluminescent device in which the power controller is configured to increase the power supply voltage when the control connection voltage of the brightest illuminated display element has not reduced to less than a second threshold value after a predetermined interval.

32. As pertaining to **claim 27,** Kimura describes the active matrix display driver configured to operate in accordance the method of claim 17 (see Fig. 1, Fig. 3, Fig. 6, and Fig. 9).

33. As pertaining to **claim 29,** Kimura teaches the display driver as claimed in claim 23 in which the electroluminescent display comprises an organic light emitting diode display (see Fig. 1; Col. 21, Ln. 5-10).

34. Again, As pertaining to **claim 31,** Kimura teaches the method as claimed in claim 17 wherein the electroluminescent display comprises an organic light emitting diode display Further, Kimura teaches that the electroluminescent display comprises an organic light emitting diode display (see Fig. 1; Col. 21, Ln. 5-10).

Conclusion

35. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Tam (US 6,847,171) teaches a compensation pixel driver circuit for an organic electroluminescent device.

Kawakami et al. (US 5,949,194) teaches a method of controlling the power supply of a display driver to maintain constant current through an electroluminescent device.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jason M. Mandeville whose telephone number is 571-270-3136. The examiner can normally be reached on Monday through Friday 7:30 AM to 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alexander Eisen can be reached on 571-272-7867. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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19 April 2007

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